DOCUMENT RESUME

ED 211 494 SP 019 292

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TITLE Instructors: Are They Significant?
PUB DATE [76]
NOTE 19p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Higher Education; *Intermode Differences; Lesson Observation Criteria; *Teacher Characteristics; Teacher Effectiveness; *Teacher Influence; *Teaching Methods; Teaching Styles; *Tennis

ABSTRACT

The effect of instructors and of using two different methods of teaching tennis on skill acquisition was investigated. Two hundred twelve subjects received beginning tennis instruction in either the traditional groundstroke (using a full grip) teaching method or the volley (using a graduated length grip) teaching method. To control teacher bias toward either method, each of the four participating teachers implemented both methods in different classes. All subjects were pre- and post-tested on the Broer-Miller Forehand-Backhand Drive Test. Results indicated that each teacher showed a preference for a particular teaching method, and that the effect of different methods cannot be statistically isolated because natural teacher variance cannot be separated from the main effect of the methods. It is suggested that future methodology studies employ several teachers and require that all teachers implement each method under investigation. (Authors/PG)

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ED211494

Instructors: Are They Significant?

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Abstract

The purpose of this study was to investigate the teacher effects in a methodology study. Two hundred twelve subjects received beginning tennis instruction from one of four participating teachers in either the traditional groundstroke teaching method with full grip or the volley teaching method with graduated length grip. Teacher bias was controlled by having each teacher implement both methods in separate classes. All subjects were pre- and post-tested on the Broer-Miller Forehand-Backhand Drive Test. Results indicated that each teacher showed a preference for a particular teaching method suggesting that the success of a particular teaching method was dependent on the instructor implementing that method. It is suggested that future methodology studies employ several teachers and require that all teachers implement each method under investigation. The statistical analysis utilized must complement the research design by allowing all possible main effects and interactions to be analyzed.

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This research study was conducted at the University of Maryland. The authors express their gratitude to Charles O. Dotson for his review of earlier drafts of this article and for his statistical assistance.

Instructors: Are They Significant?

Introduction

Perhaps the greatest problem in physical education is determining the teaching method that will maximize student performance. Through sport skills instruction, many investigators have manipulated teaching strategies among similar classes of students but have failed to identify the optimal teaching method because of the inadequate research and statistical designs employed. A survey of tennis literature that investigates the effects of numerous instructional approaches to teaching tennis reveals these shortcomings.

Farrell (1970) utilized four classes of beginning tennis players taught by four different teachers to investigate the effects of programmed instructions versus teacher-directed methods. Findings indicated that the two instructional methods were equally effective. This study, however, was not able to isolate on the effect of methods since the natural variation among teachers was not controlled.

Mariani (1970), Newman and Singer (1968), Burris-Bammel (1976), and Woods (1967) employed only one instructor to implement two or more teaching strategies. The conflicting results reported in these studies are confounded by uncontrolled teacher proclivity toward a particular strategy.

Since all the previously mentioned studies did not control for teacher effects, findings as reported did not isolate differences between methods but rather, confounded their results either with differences between teachers (Farrell, 1970) or with an individual teacher's tendency to a particular

method (Burris-Bammel, 1976; Mariani, 1970; Newman and Singer, 1968; & Woods, 1967). To be declared superior, a method must prove superior regardless of the teacher implementing that method. If an interaction exists between methods and teacher, then the superiority of one instructional method over another must consider the profile of the instructor implementing the method.

The purpose of this study, therefore, was to investigate the effects of using two different methods of teaching tennis to beginning students on the acquisition of tennis skills measured by the Broer-Miller Test. This study attempted to reduce the confounding effects of teacher bias by employing four tennis instructors with teaching experience at the university level. Teacher variability was controlled by having each teacher implement both methods in separate classes.

Method

The subjects for this study were University of Maryland students enrolled in elective coeducational beginning tennis classes instructed by one of four participating teachers. Subjects were randomly assigned to classes through the university registration process. Only those students with no previous formal instruction were included in this study. A total of 212 subjects (122 females and 90 males) received instruction from one of the four participating teachers in either the traditional groundstroke method with full grip or the volley method with graduated length grip.

The traditional groundstroke approach to tennis instruction begins with a full-grip baseline to baseline emphasis on the groundstrokes. This method emphasizes power during the acquisition of tennis skills. Proponents of the

traditional method of tennis instruction claim "the key to winning tennis lies in depth. Hitting deep denies the opponent access to the forecourt which is the attacking portion" (Fairs, 1976:66). Recently, however, the volley method combined with the graduated length grip emphasize control in the acquisition of tennis skills. This combination has been advocated as a means of accommodating early success within a controlled concept (Mason, 1974). Advocates of the controlled concept of tennis instruction propose that the losing player makes more errors than the winning player, and the key to reducing these errors is more accurate placement of groundstrokes. Speed is acceptable if it is combined with a reasonable degree of ball control and accuracy (Gray, 1976).

As a control factor all instructors followed a standardized sequence of instruction and time on task for each method. The manipulation of time on task and sequence of instruction was necessary to control for intensity x duration discrepancies among classes.

All students were pre- and post-tested on the Broer-Miller Forehand-Backhand Drive Test (Barrow and McGee, 1971). Students were pre-tested during the initial class meeting and post-tested during one of the final three days of class. This flexibility of post-test scheduling was necessary to allow for inclement weather.

The following raw data were collected for analysis: total forehand score, total backhand score, total forehand score of balls passing under the rope, and total backhand score of balls passing under the rope. Consideration of scores for balls passing under the restraining rope may be more indicative of tennis skill than simply forehand or backhand scores. It is

possible to obtain a relatively high forehand or backhand score simply by hitting high lobs into the maximal point area. Therefore, considering the score of only those balls passing under the rope indicates a more desirable measure since performance is dependent on both control and power.

A 2 x 4 x 2 (method x teachers x sex) MANOVA with repeated measures on the second and third factors was used to denote any differences between gain scores (post-test minus adjusted pre-test). This analysis was computed on the total scores for the forehand (FH), backhand (BH), forehand balls passing under the rope (FHUR), and backhand balls passing under the rope (BHUR). The Newman-Keuls test of significance was computed on the main effect of teachers and the teacher by methods interaction to denote any differences among teachers within each method. The more stringent LSD test of significance was also computed on the teacher by method interaction to denote any difference between the two methods within each teacher. In all analyses, the .05 level was used to determine the significance of these differences.

Results

The MANOVA results of the four measures (FH, BH, FHUR, BHUR) are reported in Table 1. Inspection of this table reveals a significant teacher

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Insert Table 1 about here

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effect for the FH, BH, FHUR, and BHUR measures, $F(3,195) = 4.68, 5.40, 3.71,$ and 2.88, $p < .05$ respectively, and a significant method x teacher interaction for FHUR and BHUR measures; $F(3,195) = 3.26$ and 2.96, $p < .05$ respectively. Table 2 reflects the means and standard deviations for each

measure. The variance due to the third factor, sex, is pooled with the

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Insert Table 2 about here

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residual variance as the subject's sex was not a significant factor on any measure. Newman-Keuls analysis of pre-test and post-test scores for each significant effect are presented in Tables 3 and 4.

Insert Tables 3 and 4 about here

Pre-test analyses found significance among groups only for the FHUR groundstroke measure (See Table 3) with the group assigned to teacher two reporting significantly greater scores than the groups assigned to teachers one, three and four; $q\ (r, 195) = 14.55$, 15.92, and 24.42 $p < .05$ respectively. Post-test analysis, however, found significance among teachers on three of the four measures. Table 4 indicates teacher three reported FH post-test scores significantly greater than teacher one: $q\ (r, 195) = 12.13$, $p < .05$ and both teachers two and three reported FHUR groundstroke scores significantly greater than teacher one: $q\ (r, 195) = 17.70$ and 17.96, $p < .05$ respectively.

Inspection of the BHUR groundstroke measure of Table 4 indicates that teacher two had scores significantly greater than teachers one and three, but not teacher four. Geometrically this would mean that the difference between the largest mean (T_2) and the next smallest mean (T_4) is zero, but the distance from the largest mean (T_2) to the next largest mean (T_3) is greater than zero. Clearly this is a contradiction. To avoid this type of

contradiction, Dotson and Kirkendall (1974) prescribe a sequence for testing the differences between ordered totals in which tests are always made between the means having the shortest distance between them. If the entry does not exceed the critical value, tests are subsequently made between the next set of means exhibiting the shortest distance. This procedure is repeated until a significant difference is found between the two least extreme means. Further tests of significance are not made because the implication is that significant differences will exist between two means which are more extreme. Following Dotson and Kirkendall's (1974) method, it is concluded here that teacher two significantly differs from all other teachers. It also follows that there are no significant differences among teachers one, three, and four.

Table 5 presents results of LSD tests of significance on the post-test

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Insert Table 5 about here

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differences between methods within each teacher. Inspection of this table reveals teachers one, two, and four evidencing significant differences between the volley and groundstroke methods. Figures 1 through 4 illustrate

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Insert Figures 1 through 4 about here

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both the differences among teachers for each method and between methods for each teacher. Inspection of these figures graphically illustrates the significance between methods for teachers one, two, and four, and the non-significant differences between methods for teacher three. Although all measures are not significant, teachers one and four consistently evidence

superior scores for the volley method whereas two consistently evidences superior scores the traditional groundstroke method. These findings seem to suggest that the success of a particular teaching method is dependent upon the instructor implementing that method.

Discussion

The findings of this study indicate that one cannot statistically isolate on the effect of methods since natural teacher variance cannot be partitioned from the main effect of methods. Although results of the volley method are similar regardless of the teacher involved, student achievement under the traditional groundstroke method of instruction is dependent on the teacher implementing the method. Significant differences between methods exist for three of the four instructors and a graphic analysis of the data clearly depicts an apparent proclivity of each instructor for a particular method.

The descrepancies in the literature cited earlier may well be due to the interaction effects found in this study. Clearly the studies involving one instructor (Burris-Bammel, 1976; Mariani, 1970; Newman and Singer, 1968; and Woods, 1967) reflect the bias or preference of the instructor for a particular method. The one study that utilized four teachers (Farrell, 1970) while comparing two methods of teaching tennis did not allow the interaction to reveal itself in that each teacher only taught one method to one class. Therefore, any effect due to the particular method employed by the teacher could not be ascertained.

The findings of the present study imply that the research design of future methodology studies should employ several teachers with similar expertise and experience in teaching that skill, and require that each

teacher implement each method under investigation.

It might be beneficial to obtain a profile of each instructor prior to commencement of the study. If a significant interaction results, an investigation of these profiles may reveal specific aspects of each instructor (e.g. personality, bias, experience, etc.) which contribute to the resultant interactions. The statistical analysis utilized must complement the research design by allowing all main effects and interactions to be analyzed. These include main effects for method, teacher, and sex; and interactions for method by teacher, method by sex, teacher by sex, and method by teacher by sex. If any of the above interactions prove significant, one cannot then conclude superiority of one method over another from a significant main effect for methods since the confounding interactions cannot be controlled or partialled from the main effect. Finally, the investigator must determine whether the interaction is due to differences between methods for each teacher or to differences among teachers for each method.

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Table 1

MANOVA of Forehand (FH), Backhand (BH), Forehand under rope (FHUR) Backhand under rope (BHUR)

Measure	Source	df	MS	F	p
FH	M	1	1266.92	7.08	.117
	T	3	1430.71	4.68	.004*
	S	1	1014.44	4.36	.172
	MT	3	193.23	.63	.595
	TS	3	307.81	1.01	.391
	TMS	3	314.33	1.03	.381
	Error	195	305.58		
BH	M	1	192.36	.24	.675
	T	3	2679.53	5.40	.001*
	S	1	2270.68	12.71	.070
	MT	3	214.44	.43	.730
	TS	3	452.30	.91	.436
	TMS	3	327.86	.66	.577
	Error	195	495.99		
FHUR	M	1	697.99	.54	.540
	T	3	1229.10	3.71	.013*
	S	1	7.35	.03	.875
	MT	3	1081.72	3.26	.023*
	TS	3	673.25	2.03	.111
	TMS	3	374.67	1.13	.338
	Error	195	331.43		
BHUR	M	1	1882.30	1.50	.346
	T	3	1269.83	2.88	.037*
	S	1	14.04	.22	.683
	MT	3	1300.39	2.96	.034*
	TS	3	938.08	2.23	.086
	TMS	3	276.65	.63	.597
	Error	195	440.06		

* = p .05

Table 2

Means and Standard Deviations of Teacher by Method Pre- and Post-test Scores For FH, BH, FHUR, and BHUR Scores Volley Method

	F-H		BH		FHUR		BHUR	
	pre	post	pre	post	pre	post	pre	post
T_1 mean	61.57	75.76	50.24	70.48	41.96	54.29	31.86	50.95
S.D.	19.93	15.67	19.31	16.30	25.24	27.43	19.75	20.65
T_2 mean	56.26	70.96	36.30	61.57	39.91	52.17	21.57	43.83
S.D.	19.97	24.63	22.28	22.13	20.64	29.66	16.72	24.46
T_3 mean	58.67	81.84	49.19	72.30	41.47	67.35	32.70	57.35
S.D.	25.83	24.09	24.12	29.20	26.60	30.27	25.28	31.90
T_4 mean	65.14	82.61	48.93	62.93	50.82	65.79	32.36	49.36
S.D.	24.26	22.16	20.94	21.82	29.87	31.38	19.11	24.76
			Groundstroke Method					
T_1 mean	58.21	65.46	41.96	49.54	44.50	49.67	29.33	34.50
S.D.	23.15	21.45	23.85	13.51	26.55	24.00	22.49	13.27
T_2 mean	72.42	78.89	52.37	73.74	59.05	67.37	38.42	61.26
S.D.	20.15	27.88	23.48	18.96	22.96	32.26	22.82	24.76
T_3 mean	62.69	83.63	46.13	69.06	43.13	67.63	33.13	47.63
S.D.	26.51	16.82	21.96	25.87	31.05	25.10	22.62	25.87
T_4 mean	53.87	71.68	39.32	61.34	34.63	58.16	26.68	46.79
S.D.	25.90	26.28	25.98	23.14	24.72	29.97	21.99	25.45

Table 3

Newman Keuls Pre-test Analysis of Teacher Effects and Interactions

Measure	Teacher	4	1	3	2	$q_{.95}$ (r, 195)[a]
	Mean	59.51	59.89	60.68	64.34	
	4	59.51	.38	1.17	4.81	8.85
FH	1	59.89		.79	4.45	8.09
	3	60.68			3.66	6.77
	Teacher	4	2	1	3	$q_{.95}$ (r, 195)[a]
	Mean	44.13	44.34	46.10	47.66	
	4	44.13	.21	1.97	3.53	11.30
BH	2	44.34		1.76	.32	10.30
	1	46.10			1.56	8.62
	Teacher	2	3	1	4	$q_{.95}$ (r, 195)[a]
	Mean	39.91	41.47	41.90	50.82	
	2	39.91	1.56	1.99	10.91	15.66
FHUR	3	41.47		.43	9.35	14.28
Volley	1	41.90			8.92	11.95
	Teacher	4	3	1	2	$q_{.95}$ (r, 195)[a]
	Mean	34.63	43.13	44.50	59.05	
	4	34.63	8.5	9.87	24.42*	17.30
FHUR	3	43.13		1.37	15.92*	15.77
Ground	1	44.50			14.55*	13.20
	Teacher	2	1	4	3	$q_{.95}$ (r, 195)[a]
	Mean	21.57	31.86	32.36	32.70	
	2	21.57	10.29	10.79	11.13	14.75
BHUR	1	31.86		.5	.84	13.45
Volley	4	32.36			.34	11.26
	Teacher	4	1	3	2	$q_{.95}$ (r, 195)[a]
	Mean	26.68	29.33	33.13	38.42	
	4	26.68	2.65	6.45	11.74	16.29
BHUR	1	29.33		3.80	9.09	14.86
Ground	3	33.13			5.29	12.43

a - t values computed using the harmonic mean

* - Differences exceed the q value for $q_{.95}$ (r, 195)[a]

Table 4

Newman Keuls Post-test Analysis of Teacher Effects and Interaction

Measure	Teacher	1	2	4	3	$q_{.95}(r, 195)^a$
	Mean	70.61	75.43	71.15	82.74	
	1	70.61	4.82	6.54	12.13*	8.87
FH	2	75.43		1.72	7.31	8.09
	4	77.15			5.59	6.77
	Teacher	1	4	2	3	$q_{.95}(r, 195)^a$
	Mean	60.01	62.14	67.66	70.68	
	1	60.01	2.13	7.65	10.67	11.30
BH	4	62.14		5.52	8.54	10.31
	2	67.66			3.02	8.62
	Teacher	2	1	4	3	$q_{.95}(r, 195)^a$
	Mean	52.17	54.29	65.79	67.35	
FHUR	2	52.17	2.12	13.62	15.18	15.66
Volley	1	54.29		11.50	13.06	14.27
method	4	65.79			1.56	11.95
	Teacher	1	4	2	3	$q_{.95}(r, 195)^a$
	Mean	49.67	58.16	67.37	67.63	
FHUR	1	49.67	8.49	17.70*	17.96*	17.30
Groundstroke	4	58.16		9.21	9.47	15.77
method	2	67.37			.26	13.20
	Teacher	2	4	1	3	$q_{.95}(r, 195)^a$
	Mean	43.83	49.36	50.95	57.35	
BHUR	2	43.83	5.53	7.12	13.52	14.75
Volley	4	49.36		1.59	7.99	13.45
method	1	50.95			6.40	11.26
	Teacher	1	4	3	2	$q_{.95}(r, 195)^a$
	Mean	34.50	46.79	47.63	61.26	
BHUR	1	34.50	12.29	13.13	26.76*	16.29
Groundstroke	4	46.79		.84	14.47	14.85
method	3	47.63			13.63*	12.43

a - t values computed using the harmonic mean

* - Differences exceed the q value for $q_{.95}(r, 195)^a$

Table 5

LSD Analysis of Methods Within Teacher Effect[a]

Measure	Teacher 1	2	3	4
FH	1.97	-1.66	.35	2.51*
BH	3.15*	-1.78	.50	.29
FHUR	.85	-2.72*	- .05	1.68
BHUR	2.62*	-2.71*	1.58	.49

a - t values computed using the harmonic mean

* - Differences exceed the table value for $t_{.95}$ (d.f. = 1,195)

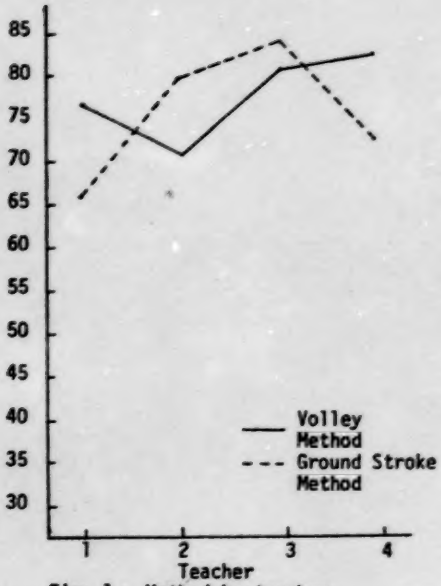

Fig. 1 - Method by teacher Interaction of FH measure

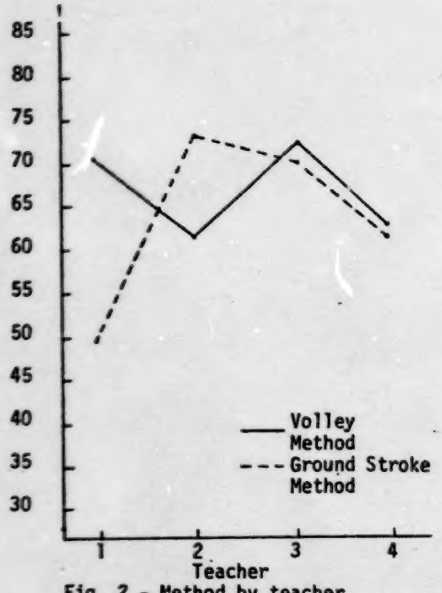

Fig. 2 - Method by teacher Interaction of BH measure

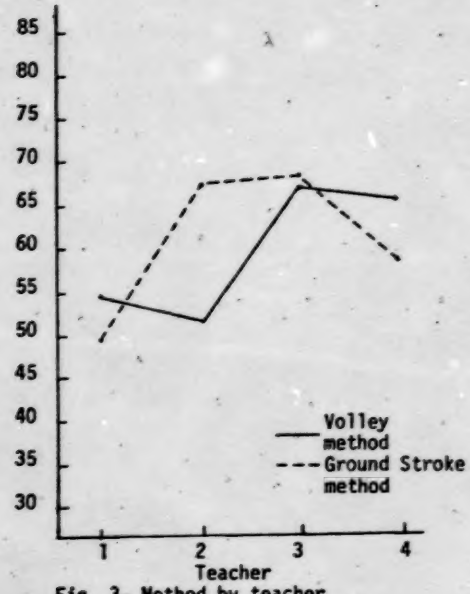

Fig. 3- Method by teacher Interaction of FHUR measure

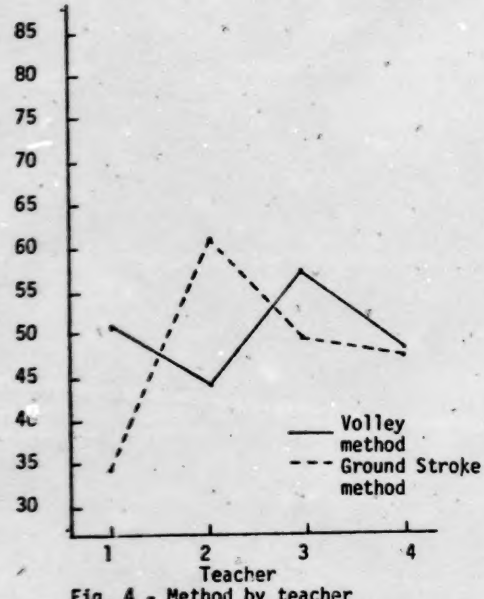

Fig. 4 - Method by teacher Interaction of BHUR measure